



## Repetitive stress and Contact-related injuries in contact Sports: A Comprehensive review

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### Abstract

Contact sports, characterized by frequent physical collisions and high mechanical forces, present unique injury risks across all levels of participation. Traditional Indian contact sports like Kabaddi, Kho-Kho, and Wrestling (Kushti) are deeply rooted in the nation's culture and contribute to physical fitness, agility, and teamwork. However, due to their high-intensity, body-contact nature, these sports carry a substantial risk of injury. This review highlights the incidence, types, mechanisms, long-term implications, and prevention of injuries in Indian contact sports, integrating current national and international evidence.

**Keywords:** Contact sport, injury, overuse syndrome, repetitive stress injury, rehabilitation.

### Introduction

Contact sports such as rugby, American football, and ice hockey are among the most physically demanding athletic activities, combining strength, speed, and frequent player-to-player collisions. While they promote fitness and social engagement, they also pose a high risk of acute and chronic injuries. Understanding injury patterns, mechanisms, and prevention strategies is essential for safe participation and effective rehabilitation (Koh et al., 2003) [9].

India has a rich tradition of indigenous contact sports that combine physical endurance, strategy, and close physical engagement. Among these, Kabaddi, Kho-Kho, and Wrestling (Kushti) stand out as culturally significant and widely practiced both at the grassroots and professional levels (Pal et al., 2022) [11]. With the professionalization of Kabaddi through the Pro Kabaddi League (PKL) and increased participation in wrestling at global events, understanding the epidemiology and prevention of related injuries has become vital for athlete welfare.

### Incidence And Types of Injuries

Epidemiological studies demonstrate that concussions and spinal injuries are the most prevalent and severe in contact sports. In high school male team sports, ice hockey reported the highest concussion incidence (3.6 per 1,000 athlete-exposures), compared with soccer (0.18 per 1,000 athlete-exposures) (Koh et al., 2003) [9]. Catastrophic cervical spine injuries (CCSIs) are less frequent but carry devastating consequences, with reported rates ranging from 0.6 to 7.2 per 100,000 player-years in rugby and American football (Tator et al., 2017). Additionally, upper extremity injuries—especially to the hand, wrist, and fingers are common among professional and amateur contact sport athletes (Grant et al., 2024). Repeated exposure to head and neck impacts can also lead to structural and sensorimotor changes in the cervical spine (Cheever et al., 2022) [2].

Injury incidence in Indian contact sports is high, particularly in Kabaddi, where rapid tackling, raiding, and ankle holds expose players to acute musculoskeletal trauma (Hendrawan et al., 2024) [6]. Studies indicate that lower limb injuries account for 45–55% of all Kabaddi injuries, followed by upper limb and head injuries (Meena et al., 2025) [10]. Common diagnoses include ankle sprains, knee ligament

strains, shoulder dislocations, and finger fractures. In wrestling, repetitive joint stress and high body impact during throws and locks often result in cauliflower ear, shoulder injuries, lumbar strains, and skin infections due to mat exposure (Patel, 2024; Agarwal & Mann, 2017; Granhed & Morelli, 1988) [1, 5, 11, 12]. Kho-Kho, though slightly less contact-heavy, shows a predominance of lower extremity injuries, particularly hamstring and ankle strains, attributed to sudden sprints and direction changes (Pal et al., 2022).

### Mechanisms of Injury

Most injuries in contact sports occur due to direct physical impacts, high-speed tackles, or repetitive acceleration-deceleration forces. Concussions are described as complex pathophysiological processes affecting the brain, induced by biomechanical forces (Stuart et al., 2017) [15]. In rugby and American football, tackling and scrummaging are responsible for a large proportion of catastrophic spine injuries (Hutton et al., 2016) [8]. Repeated cervical loading has been linked to changes in neuromuscular control and proprioception, increasing the risk of further injuries to the neck and shoulder region (Cheever et al., 2022) [2].

In Kabaddi and Kho-Kho, injuries primarily occur from tackling, raiding maneuvers, and rapid accelerations. The dynamic actions such as lunging and blocking often involve unanticipated body collisions, contributing to ligamentous and soft-tissue damage (Hendrawan et al., 2024) [6]. In wrestling, the mechanism often involves hyperextension, twisting, or impact during grappling, leading to musculoskeletal and joint injuries (Agarwal, S., & Mann, E. 2017) [1]. Environmental factors such as inadequate protective mats, uneven surfaces, and insufficient warm-up further amplify the risk in amateur and rural settings (Granhed & Morelli, 1988) [5].

### Long-Term Consequences

The long-term effects of repeated contact sport injuries extend beyond the acute phase. Retired athletes often experience chronic pain, degenerative joint conditions, and neurocognitive issues. A retrospective study found that retired rugby athletes had significantly higher cumulative injury rates and long-term musculoskeletal complications

compared with non-contact sport athletes (Hind et al., 2020)<sup>[7]</sup>. Moreover, repetitive sub-concussive impacts can lead to subtle neurological dysfunctions even in the absence of clinically diagnosed concussion (Cheever et al., 2022)<sup>[2]</sup>. Recurrent contact injuries in these sports may result in chronic musculoskeletal disorders, early-onset osteoarthritis, and reduced athletic longevity. Wrestlers are particularly susceptible to chronic back pain and degenerative joint changes, while Kabaddi players often develop persistent knee and shoulder instability (Pal et al., 2022)<sup>[11]</sup>. Additionally, repetitive head impacts, though less common than in Western contact sports, have raised emerging concerns about potential mild traumatic brain injuries in elite Kabaddi players (Meena et al., 2025)<sup>[10]</sup>.

### Prevention and Management Strategies

Effective prevention programs integrate rule modifications, protective equipment, conditioning, and education. Strength and neuromuscular training are particularly effective in reducing injury risk. A recent meta-analysis reported that adherence to structured strength-training programs reduced overall injury incidence in contact sports by approximately 30% (Chen et al., 2025)<sup>[3, 4]</sup>. In addition, individualized rehabilitation protocols are vital for hand and wrist injuries (Grant et al., 2024). Medical screening, cervical stability exercises, and improved coaching practices also play crucial roles in reducing head and neck trauma (Stuart et al., 2017)<sup>[15]</sup>.

Injury prevention in Indian contact sports should integrate sports-specific conditioning, balance and proprioceptive training, and safe tackling education. Evidence suggests that neuromuscular training and strength-based injury prevention programs significantly reduce injury incidence across contact sports (Chen et al., 2025)<sup>[3, 4]</sup>. Implementation of standardized injury surveillance systems for Kabaddi and Wrestling is urgently needed in India to monitor trends and outcomes. Use of protective gear, proper mat maintenance, and mandatory physiotherapy screening can further enhance athlete safety (Meena et al., 2025)<sup>[10]</sup>. Rehabilitation programs should focus on restoring joint stability, flexibility, and strength, ensuring a safe and sustainable return to competition (Pérez Armendáriz et al., 2023)<sup>[13]</sup>.

### Discussion

Despite improved surveillance and awareness, injury prevention in contact sports continues to face challenges. Heterogeneity in study design, varying definitions of injury, and inconsistent reporting methods hinder data comparability (Hind et al., 2020)<sup>[7]</sup>. Furthermore, research on cumulative exposure and its relation to chronic musculoskeletal disorders remains limited (Cheever et al., 2022)<sup>[2]</sup>. Future studies should adopt standardized injury-reporting systems and explore long-term health trajectories across both professional and amateur athletes.

Despite their cultural significance, Indian contact sports lack the extensive research and preventive infrastructure seen in Western sports. Most data come from small-scale observational studies or regional tournaments (Hendrawan et al., 2024)<sup>[6]</sup>. To align with international standards, India requires a national injury surveillance database, multidisciplinary medical teams, and inclusion of sports physiotherapists at all competition levels. Future research should emphasize sex-specific analysis, long-term health tracking, and comparative biomechanics across Indian and global contact sports.

### Conclusion

Contact sports present a complex interplay between physical performance and injury risk. While concussions, spinal trauma, and upper limb injuries remain major concerns, evidence supports that preventive strength training, education, and regulatory reforms significantly mitigate injury rates. Continued multidisciplinary research and implementation of evidence-based protocols are essential to safeguard athlete health while maintaining the integrity of competitive sport.

Kabaddi, Kho-Kho, and Wrestling embody India's sporting spirit but also carry significant injury risks. Recognizing and addressing the specific patterns, mechanisms, and consequences of contact sport injuries in Indian contexts is essential. Integrating scientific injury-prevention strategies, athlete education, and medical support can ensure that these traditional games continue to thrive safely in both national and international arenas.

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